

## N O T I C E

THIS DOCUMENT HAS BEEN REPRODUCED FROM  
MICROFICHE. ALTHOUGH IT IS RECOGNIZED THAT  
CERTAIN PORTIONS ARE ILLEGIBLE, IT IS BEING RELEASED  
IN THE INTEREST OF MAKING AVAILABLE AS MUCH  
INFORMATION AS POSSIBLE

215  
(NASA-TM-76321) ORTHOCLINOSTATIC TEST AS  
ONE OF THE METHODS FOR EVALUATING THE HUMAN  
FUNCTIONAL STATE (National Aeronautics and  
Space Administration) 8 p HC A02/MF A01

N80-32070

CSCL 06P G5/52 28683  
Unclass

NASA TECHNICAL MEMORANDUM

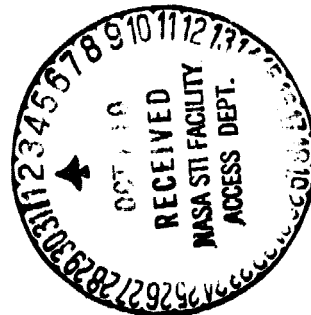
NASA TM-76321

ORTHOCLINOSTATIC TEST AS ONE OF THE METHODS FOR  
EVALUATING THE HUMAN FUNCTIONAL STATE

Candidate of Medical Sciences V. A. Doskin,  
Doctor of Medical Sciences L. D. Gissen, Candidate  
of Biological Sciences O. Z. Bomshteyn, E. N. Merkin,  
and S. B. Sarychev

Translation of "Ortoklinostaticheskaya proba kak odin  
iz metodov otsenki funktsional'nogo sostoyaniya chelo-  
veka," Gigiyena i sanitariya, No. 4 (April), 1979, pp.  
41-44.

REPRODUCTION RESTRICTIONS OVERRIDDEN  
NASA Scientific and Technical Information Facility



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
WASHINGTON D.C. 20546  
AUGUST 1980

## STANDARD TITLE PAGE

1. Report No. NASA TM-76321	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle ORTHOCLINOSTATIC TEST AS ONE OF THE METHODS FOR EVALUATING THE HUMAN FUNCTIONAL STATE		5. Report Date AUGUST 1980	
		6. Performing Organization Code	
7. Author(s) V. A. Doskin, L. D. Gissen, O. Z. Bomshteyn E. N. Merkin and S. B. Sarychev		8. Performing Organization Report No.	
		10. Work Unit No.	
9. Performing Organization Name and Address SCITRAN Box 5456 Santa Barbara, CA 93108		11. Contract or Grant No. NASW-3198	
		13. Type of Report and Period Covered Translation	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, D.C. 20546		14. Sponsoring Agency Code	
15. Supplementary Notes Translation of "Ortoklinostaticheskaya proba kak odin iz metodov otsenki funktsional'nogo sostoyaniya cheloveka", Gigiyena i sanitariya, No. 4 (April), 1979, pp. 41-44			
16. Abstract This is a discussion of a special study, whose first stage examined the possible use of different methods to evaluate the autonomic regulation in hygienic studies. We tried to select the simplest and most objective tests.  As shown by the first results, the use of the new standards not only makes it possible to detect earlier unfavorable shifts, but also permits a quantitative characterization of the degree of impairment in the state of the organism. Here precise interpretation of the observed shifts is possible.  Thus, the standards can serve as one of the criteria for evaluating the state and can be widely used in hygienic practice.			
17. Key Words (Selected by Author(s))		18. Distribution Statement THIS COPYRIGHTED SOVIET WORK IS REPRODUCED AND SOLD BY NTIS UNDER LICENSE FROM VAAP, THE SOVIET COPYRIGHT AGENCY. NO FURTHER COPYING IS PERMITTED WITHOUT PERMISSION FROM VAAP.	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 8	22.

ORTHOCLINOSTATIC TEST AS ONE OF THE METHODS FOR  
EVALUATING THE HUMAN FUNCTIONAL STATE

Candidate of Medical Sciences V. A. Doskin, Doctor  
of Medical Sciences L. D. Gissen, Candidate of  
Biological Sciences O. Z. Bomshteyn, E. N. Merkin,  
and S. B. Sarychev\*

Study of the reactivity of the autonomic nervous system is widely used in /41\*\*  
hygienic practice; its functional state reflects the degree of emotional stress  
and the nature of the energy supply for the functions (A. M. Veyn; M. R. Mogendovich). For a further development and perfection in the methods of studying the  
autonomic nervous system we undertook a special study, whose first stage  
examined the possible use of different methods to evaluate the autonomic regulation in hygienic studies. We tried to select the simplest and most objective  
tests. One of them is the clinostatic reflex of Danielopulo and the orthostatic reflex of Prevel that can be united into a single orthoclinostatic test.  
It has been established that the posture-autonomic reactions have multiple-component afferentation (proprioceptive, vestibular, exteroceptive, visceral).  
They are implemented by means of reflexes from baroreceptors and motor-visceral reflexes, and in the normal condition of the organism the motor reflexes dominate over the visceral (M. R. Mogendovich.; Zh. Sherer). The precise mechanism for  
this reflex is not known, but there are indications of its complicated vestibulo-stem-hypothalamo-cardiovascular nature (G. P. Guba).

Passive and active versions exist for the orthoclinostatic test. In the first the subject is rotated on a special turning table, and in the second he independently alters and actively maintains the adopted posture. It is

\*Institute of Children and Adolescent Hygiene of the USSR Ministry of Public Health, Moscow; All-Union Scientific Research Institute of Physical Culture, Moscow.

\*\*Numbers in margin indicate pagination in original foreign text.

evident that in the active test the cardiovascular system is affected by a greater number of factors than in the passive. However, the conducting of the latter requires additional equipment.

Evaluation of the shifts in the active version of the test is difficult according to the extant standards. Considerable pulse oscillations are accepted in them as the normal: slowing down of the pulse by 4-6 beats per minute during the transition from the vertical position to the horizontal, and increase in frequency by 6-24 beats per minute during the transition from the horizontal position to the vertical (G. P. Guva; G. V. Arkhangel'skiy). These norms are mainly directed towards detecting the pronounced pathology, therefore they do not permit a quantitative diagnosis of different changes in the functional state of a healthy person.

Taking into consideration the possible effect on the standards of certain social and biological factors (these norms have not been reviewed in over 30 years) and desiring to perfect the standards, we set ourselves the task of formulating new standardized indicators for evaluating the orthoclinostatic test. In order to work out new standards 214 practically healthy students were tested (107 men and 10 women) in age from 17 to 29 representing a homogeneous sampling. All the studies were conducted at the same time, 1½-2 hours after eating.

We tested different versions of conducting the orthoclinostatic test, as a result of which we empirically selected the most applicable plan for hygienic studies. Before the orthoclinostatic test the subjects sat for several minutes, /43 then stood for 3-4 minutes for complete adaptation to this pose. Then they switched to the lying position. Within 1 min. 40 s the subjects stood up. The pulse rate was recorded by palpation in 20-second time intervals: in the initial position standing, in the first 20 s after switching to the lying position, in 1 min. 20 s of stay in a horizontal position, and in the first 20 s after standing up. The need for repeated measurement of the pulse in the lying position was due to the fact that only by the end of the stay in this posture did stabilization of the cardiac contraction rate occur. In 37 people in this time interval the arterial pressure (AP) was measured. All the data obtained in the examination were processed on a computer. During the transition from the vertical to the



horizontal position a certain increase occurred in the systolic and drop in the diastolic AP in the subjects. During standing up a reliable increase was observed in the systolic and diastolic AP, while the frequency of cardiac contractions dropped in the lying position and rose in standing up (table 1).

The values for the correlation coefficients between the 8 series of indicators of the pulse in two independent samplings (men and women) fluctuated from 0.03 to 0.18 (absence of a link) and only in single cases was a moderate link observed (correlation coefficients from 0.3 to 0.32). Within each sampling, the correlation coefficients were considerably higher--from 0.43 to 0.75 (from moderate to considerable link). Based on a comparison of the latter between the series of two independent samplings and in each of them one can draw a conclusion on the presence of a considerable link between the pulse rate in different positions.

The distribution of probabilities for the values of the difference in the number of pulse beats during the change of body position in the majority of cases was bimodal, which indicates the effect on the organism's reaction of at least two factors: excitation of the sympathetic or parasympathetic nervous system. In different people in the given time activation of a certain section of the nervous system can dominate.

As shown by an analysis of the distribution curves, as well as an evaluation of the values for the coefficients of asymmetry and excess (see table 1), the grouped indices for the rate of cardiac contractions are not subordinate to the law of normal distribution. There were deviations from it in the organized series of values for the differences in pulse rate between the different measurement moments, therefore to work out the standards we dwelt on the percentile method (D. Glass and O. Stenli; D. Sepetliyev). As is known, the method of percentiles, one of the types of nonparametrical analysis, is being used more and more in working out different standards, since it is applicable almost to any forms of distribution.

In order to determine the norms, our data were grouped in intervals that were uniformly separate from each other, and to obtain the corresponding percentiles the following formula was used:

$$P_x = H + \frac{C}{K} E.$$

Where  $P_x$ --unknown percentile,  $H$ --lower boundary of interval in which the unknown percentile is located,  $C$ --number of cases that it is required to add to the cumulative series of cases of the prepercentile interval in order to obtain the ordinal number of the percentile case,  $K$ --number of cases of the percentile interval,  $E$ --size of the percentile interval.

In practice, only some of the percentiles are used most often:  $P_3$ ,  $P_{10}$ ,  $P_{25}$ ,  $P_{50}$ ,  $P_{75}$ ,  $P_{90}$  and  $P_{97}$ , therefore we presented all the results for the change in pulse rate during the transition from one position to another in the form of a discrete seven-interval scale separately for men and women (table 2).

Table 2. Intervals of Standards

Difference in pulse rate in 20 s with change in body position between poses

Standing and lying

Standing and lying in 1 min 20 s

Lying and standing

Lying in 1 min 20 s and standing

Percentiles						
$P_3$	$P_{10}$	$P_{25}$	$P_{50}$	$P_{75}$	$P_{90}$	$P_{97}$
-5	-3	-1	+2	+4	+6	+9
-6	-3	-1	+1	+4	+6	+12
-5	-1	+1	+3	+6	+7	+9
-2	-1	+1	+3	+6	+8	+11
-10	-7	-6	-3	-1	+0	+2
-9	-8	-6	-3	-1	+1	+2
-10	-8	-7	-5	-3	-1	+0
-12	-10	-8	-6	-4	-1	0

Note: Numerator--indices for men, denominator--for women.

It is apparent from table 2 that conditionally isolated standard (increase or decrease in pulse rate in boundaries from  $P_{25}$  to  $P_{75}$ ) is almost the same for men and women. The difference in the pulse oscillations between the men and women is sharply increased only towards the extreme percentiles. This indicates the correctness of formulating standards with regard for the sex, although for approximate studies it is sufficient to isolate the zone of normal oscillations of the pulse in the orthostatic test without consideration for the sex.

A change in pulse in the limits of the isolated standard can indicate the resistance of the organism to the orthoclinostatic load, which in turn is an adequate indicator of the circulatory system regulation.



As shown by the first results, the use of the new standards not only makes it possible to detect earlier unfavorable shifts, but also permits a quantitative characterization of the degree of impairment in the state of the organism. Here precise interpretation of the observed shifts is possible (A. M. Veyn; L. G. Gruyeva).

Thus, the standards can serve as one of the criteria for evaluating the state and can be widely used in hygienic practice.

#### References

- Arkhangel'skiy, G. V. Rukovodstvo k prakticheskim zanyatiyam po nevropatologii ["Handbook for Practical Studies on Neuropathology"], Moscow, 1971.
- Veyn, A. M. Lektsiya po nevrologii nespetsificheskikh sistem mozga ["Lectures on Neurology of Nonspecific Cerebral Systems"], Moscow, 1974.
- Glass, D.; and Stenli, O. Statisticheskiye metody v pedagogike i psikhologii ["Statistical Methods in Pedagogy and Psychology"], Moscow, 1976.
- Gruyeva, L. G. Gig. i san., No. 4, (9167), p. 105-108.
- Guba, G. P. Nevrologicheskiy simptomy, sindromy i funktsional'nyye proby ["Neurological Symptoms, Syndromes and Functional Tests"], Kiev, 1969.
- Mogendovich, M. R. Lektsii po fiziologii motorno-vistseral'noy regulyatsii ["Lectures on the Physiology of Motor-Visceral Regulation"], Perm', 1972.
- Sepetliyyev, D. Statisticheskiye metody v nauchnykh meditsinskikh issledovaniyakh ["Statistical Methods in Scientific Medical Studies"], Moscow, 1968.
- Sherer, Zh. in Fiziologiya truda ["Physiology of Labor"], Moscow, 1973, p. 140.

*COPYRIGHT: GIGIYONA i SANITARIYA, 1979*